

Application Serial No. 10/560,804
Reply to Office Action of June 25, 2009

PATENT
Docket: CU-4560

REMARKS

In the Office Action, dated June 25, 2009, the Examiner states that Claims 1-40 and 45-63 are pending and rejected. By the present Amendment, Applicant cancels Claims 27-30, 33-35, 46-51, 56-61 and 63.

Rejection under 35 U.S.C. §103(a)

Claims 1-7, 11-40 and 45-63 are rejected under 35 U.S.C. §103(a) as being unpatentable over US 2004/0050208 (Nie et al.). Applicant respectfully disagrees with and traverses this rejection.

At the outset, Applicant indicates that solely in the interest of advancing prosecution, and without prejudice or disclaimer of the subject matter thereof, Claims 27-30, 33-35, 46-51, 56-61 and 63 have been cancelled.

With respect to the foregoing rejection, it appears that the Office Action may have mischaracterized the disclosure of Nie et al. Applicant respectfully asserts that the methods disclosed by Nie et al. are fundamentally different than the methods defined by the pending claims of the present application. The methods disclosed by Nie et al. involve the reduction of a "precursor material" with a "reducing gas" to form an "elemental material" in a first step. The products of that reduction reaction are then exposed to a "reductant material" in a second step. In one embodiment described by Nie et al., the first step involves TiCl₄ being directly reduced with hydrogen to form titanium metal and HCl gas and then, in the second step, the HCl gas is reacted with aluminum to form H₂ and AlCl₃ vapour.

Applicant asserts that the reason aluminum (or any of the numerous other "reductant materials") is included in the method disclosed in Nie et al. is to continuously drive the reaction between TiCl₄ and H₂ by removing one of the reduction reaction products (i.e. HCl) and to regenerate H₂. See, e.g., paragraphs [0037], [0050] and [0054].

In some embodiments (see paragraphs [0069] to [0073] of Nie et al.), a "seed" may be included in the first reaction in order to form an "alloy of elemental materials." In one embodiment described by Nie et al., the precursor material is TiCl₄ and the seed is Al, and the process results in the formation of a Ti-Al alloy. However, Applicant asserts that in all of the methods disclosed in Nie et al., the reduction of the precursor material is always caused by the reducing gas. In the embodiments involving a seed material, the reduced precursor material deposits on the seed

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material to form an alloy with the seed material (see paragraph [0069]). Thus, the seed material does not reduce the precursor material.

Applicant respectfully asserts that Nie *et al.* clearly indicates that if aluminum is used in the reaction, then it would not reduce TiCl₄ to form useful products, let alone to trigger reactions to form titanium subchlorides and aluminum chloride products. Indeed, at paragraphs [0060] to [0065], Nie *et al.* describes that TiCl₄ will not react with Al if H₂ is present because H₂ is much more reactive than Al metal.

In contrast, the invention defined by the amended claims does not involve a reducing gas, but involves a direct reaction between TiCl₄ and aluminum, in which the TiCl₄ is reduced by the aluminum to form titanium subchloride(s) and AlCl₃ products for use in the second step of the claimed method. Applicant respectfully asserts that this is a fundamentally different reaction to those disclosed in Nie *et al.* In view of the foregoing, Applicant submits that the present invention and Nie *et al.* differ in numerous very important respects, and not just in that Nie *et al.* allegedly does not explicitly disclose one feature of the claimed invention.

In this respect, as the Office Action noted, Nie *et al.* does not specify that titanium subchlorides are formed as intermediate reaction products but the Office Action contends that this would inherently occur. However, Applicant submits that because hydrogen is used to directly reduce TiCl₄ to titanium metal in the method disclosed in Nie *et al.* (see, e.g. paragraphs [0028], [0033] and [0049]), titanium subchlorides would not formed.

Applicant further submits that Nie *et al.* explicitly teaches away from reducing TiCl₄ with aluminum. As noted above, Nie *et al.* teaches that Al will not react with TiCl₄ in the presence of H₂. Further, at paragraph [0066], Nie *et al.* teaches that directly reacting TiCl₄ with metal (e.g. Al) will result in the formation of a mixture of products. Indeed, as Applicant has previously submitted, the formation of uncontrollable mixtures of reaction products following direct reaction between TiCl₄ and aluminum is a problem known in the art. Nie *et al.* addresses this problem by using hydrogen as a reducing agent. The presently claimed invention uses a different method to solve this problem.

Nie *et al.* further teaches away from the present invention at paragraph [0041], where it is stated "After the elemental material is formed, it should be separated from the other substances...the elemental material and the reluctant will

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not come into contact with each other regardless of whether being present in the same reaction vessel". Thus, Nie *et al.* teaches that the Ti metal or alloy formed is to be isolated from the reluctant material (e.g. the Al added). Applicant submits that Nie *et al.* teaches against directly contacting these materials for reasons similar to those described in the specification for the present application (i.e. the formation of uncontrollable reaction products).

In summary, Applicant respectfully submits that the Office Action has misinterpreted the disclosure of Nie *et al.* Nie *et al.* discloses a process in which TiCl₄ is directly reduced by hydrogen to form titanium metal. Aluminum may subsequently be used in a second step for the purpose of reacting with the HCl formed during the initial reaction, and thus driving the first reaction, as well as regenerating H₂.

Applicant further submits that Nie *et al.* actively teaches away from the present invention by teaching that direct reaction between TiCl₄ and Al is disadvantageous because it results in the formation of uncontrollable reaction products. For these reasons, Applicant respectfully submits that the invention defined by the pending claims is not obvious in light of Nie *et al.*

In light of the foregoing response, all the outstanding objections and rejections are considered overcome. Applicant respectfully submits that this application should now be in condition for allowance and respectfully requests favorable consideration.

September 16, 2009

Date

Respectfully submitted,



Attorney for Applicant
Eric D. Babych
c/o Ladas & Parry LLP
224 South Michigan Avenue
Chicago, Illinois 60604
(312) 427-1300
Reg. No. 57,542